



ANALYSIS

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The Economics of Puerto Rico's Post-Maria Recovery

Introduction

A year has passed since Hurricane Maria made landfall on Puerto Rico, and the territory is still reeling from the humanitarian and economic crisis it left behind. The revised death toll of nearly 3,000 people speaks to the sheer scale of the disaster. The hurricane also weakened the economy's foundations significantly. About \$80 billion in damages crippled the island's capital stock, and at least \$25 billion in lost output is estimated to have battered business and household balance sheets. Most important, more than 150,000 Puerto Ricans have left the island for the U.S. mainland due to Hurricane Maria. Many will not return.

The Economics of Puerto Rico's Post-Maria Recovery

BY BERNARD YAROS

A year has passed since Hurricane Maria made landfall on Puerto Rico, and the territory is still reeling from the humanitarian and economic crisis it left behind. The revised death toll of nearly 3,000 people speaks to the sheer scale of the disaster. The hurricane also weakened the economy's foundations significantly. About \$80 billion in damages crippled the island's capital stock, and at least \$25 billion in lost output is estimated to have battered business and household balance sheets. Most important, more than 150,000 Puerto Ricans have left the island for the U.S. mainland due to Hurricane Maria. Many will not return.

Though rebuilding and disaster aid have helped prop up economic activity, most Puerto Ricans are not satisfied with the job the government has done.¹ Yet, the island's residents will have to rely on both the federal and commonwealth governments to fund the post-Maria recovery.

This article will give some background to Puerto Rico's never-ending recession, demonstrate why this experience is different from past hurricanes, quantify the economic loss, and review the economics of federal disaster aid. To conclude, this analysis will consider three potential paths that fiscal policymakers in Washington and San Juan could take over the next decade: Governor Ricardo Rosselló's latest reconstruction plan, the federal control board's new fiscal plan, and the Rubio-Hatch bill. Based on results from the Moody's Analytics econometric model of Puerto Rico's economy, this article will conclude with a discussion of the economic implications of these three proposals.²

¹ "Residents see a failure at all levels of government," *Washington Post*, September 2018. https://www.washingtonpost.com/news/national/wp/2018/09/12/feature/residents-see-a-failure-at-all-levels-of-government/?utm_term=.732021afffde

² A description of the Moody's Analytics regional econometric models is available upon request.

A string of misfortunes

Puerto Rico could ill afford a natural disaster, let alone the third costliest hurricane in U.S. history after Katrina and Harvey (see Chart 1). Before Maria, the island was in the grips of a more than decade-long economic downturn. Historically, the business cycles of Puerto Rico and the U.S. mainland moved in tandem. Yet, this relationship broke down right before the Great Recession, and Maria's impact has further widened the gulf between the economic performances of the two (see Chart 2).

The first major setback to the economy occurred in 2006 when Congress fully phased out IRS Section 936 provisions, which were lucrative tax breaks for U.S. companies, mostly in life sciences, that set up operations on the island. Lofty oil prices at or above \$100 per barrel exacerbated the high cost of doing business on the island.

Yet, the coup de grâce was the Great Recession, which sent the housing market into a tailspin. The figures behind Puerto Rico's long-run decline are staggering. Before Maria, GDP was down by about 16% from its high in 2003, and employment and house prices had fallen nearly 18% and 28%, respectively, from their prerecession peaks. The most pernicious consequence of the never-ending recession has been rampant out-migration. During the five years before Maria an average of more than 60,000 net migrants left for work in the rest of the U.S. each year. Moreover, the rate of out-migra-

Chart 1: Maria Was Among Very Worst

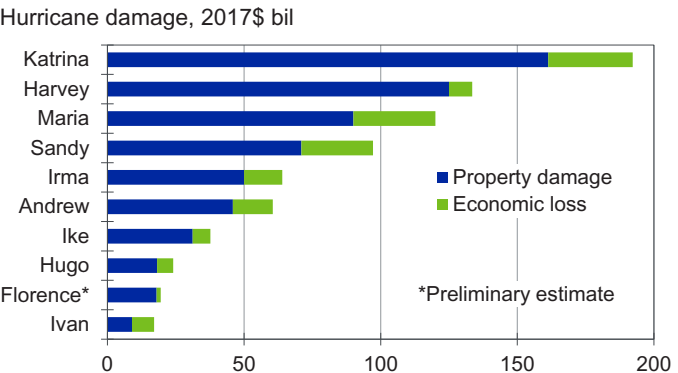
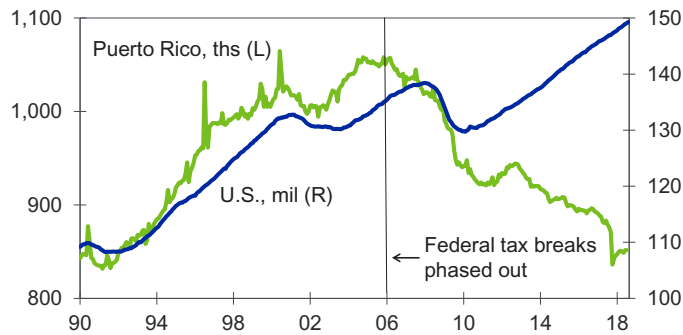


Chart 2: No Longer on the Same Page

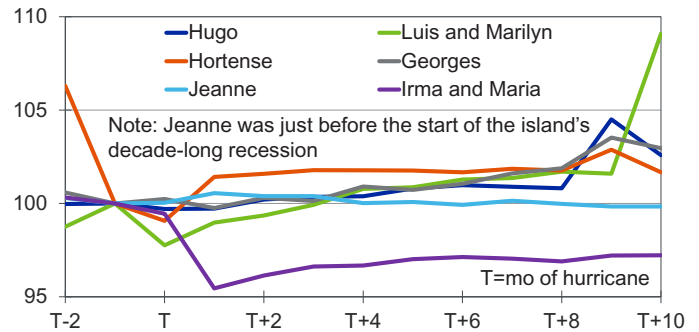
Nonfarm payroll employment, SA



Sources: BLS, Moody's Analytics

Chart 3: Labor Market Usually Recovers

Puerto Rico, nonfarm payrolls indexed to mo prior to hurricane



Sources: BLS, Moody's Analytics

tion progressively worsened as the allure of the mainland strengthened with the U.S. economy returning to full employment and wage growth firming. Consequently, Puerto Rico's population shrank by more than a tenth, from a peak of 3.8 million in 2004 to 3.3 million right before Maria.

The commonwealth government is stuck in a negative feedback loop due to such grim demographics. A declining population whittles away at the tax base and, accordingly, its wherewithal to make critical public investments and provide essential services, which in turn weighs down on the quality of life of residents and prompts further out-migration.

Yet, demographics are not the main culprit of the some \$70 billion in debt the commonwealth owes. For perspective, public debt per capita in Puerto Rico is far higher than in any U.S. state. Years of fiscal irresponsibility led to its debt crisis, which came to a head in June 2015 when then Governor Alejandro Garcia Padilla declared the island's debt "not payable."³ The declaration was followed by a series of missed bond payments that risked setting off a messy litigation process.

In 2016 Congress passed the Puerto Rico Oversight, Management and Economic Stability Act, also known as PROMESA. The law imposed an automatic stay on creditor lawsuits and, most important, created a federal fiscal oversight board with the

power to enforce balanced budgets and petition for a court-supervised debt restructuring on behalf of Puerto Rico. PROMESA provided much-needed legal and fiscal certainty,⁴ but it did not alleviate the island's economic woes.

This time is different

Puerto Ricans are all-too-familiar with economic hardship, and severe hurricanes are nothing new as well. Prior to Maria, FEMA had issued eight disaster declarations on the island over the last six decades because of hurricanes, including Irma, which grazed its northern coast just two weeks before Maria.

Maria stands out from the rest, though. First, the discrepancy between the damage wrought during Maria and others that struck the island is stunning. In 1998, Puerto Rico incurred damages amounting to \$5 billion in 2017 dollars during Georges—the next costliest hurricane for the island after Maria.⁵ Second, with the exception of Irma, severe flooding associated with Kyle in 2008, and Jeanne in 2004, the fundamentals of Puerto

Rico's economy were much stronger during all other hurricanes.

Payroll employment in Puerto Rico typically falls in the month of a hurricane or the following one. Between September and October 2017, the island's labor market shed 35,000 jobs. Ten months after most major hurricanes, employment has recovered and risen past its pre-hurricane peak (see Chart 3). Yet, as of July, barely more than half of the 35,000 jobs lost have been recouped.

When a hurricane makes a dent in payroll employment, initial claims for unemployment insurance rocket higher (see Chart 4). The absolute increase in jobless claims, as a share of Puerto Rico's population, between August 2017 and their peak three months later was even greater than that observed during and after Georges.

The economy's long-lost resiliency to hurricanes is even more striking when output is considered. Historically, real GDP has come out largely unharmed by hurricanes (see Chart 5). In the case of David and Georges, real output dipped slightly in the following quarter but then swiftly rebounded. After Hortense and the one-two punch of Luis and Marilyn, real GDP slowed appreciably for a quarter or two but then assumed an even faster growth rate than immediately before those hurricanes. Economic output barely blinked at Hugo. Jeanne was the first to expose the economy as no longer as resilient to natural disasters. None compare with the estimated output loss due to Irma and Maria, though.

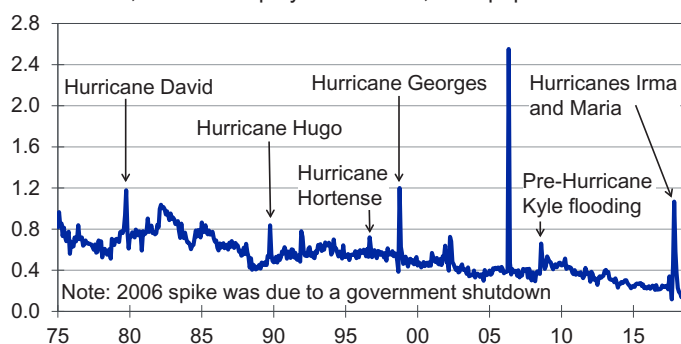
³ "Puerto Rico's Governor Says Island's Debts Are 'Not Payable,'" *New York Times*, June 2015. <https://www.nytimes.com/2015/06/29/business/dealbook/puerto-ricos-governor-says-islands-debts-are-not-payable.html>

⁴ In 2015, Moody's Analytics put forth two economic scenarios for the island: one in which Congress enacted a set of proposals made by Treasury officials in the Obama administration and the other in which Congress did not act, leaving Puerto Rico to unsuccessfully fend for itself in court as it began to default on its debt. See M. Zandi, D. White and B. Yaros, "Puerto Rico Looks Into the Abyss," Moody's Analytics Economy.com, November 2015. <https://www.economy.com/getlocal?q=bfb7b3b7-8f0d-44b9-8399-16e6271fd36c&app=eccafile>

⁵ R. Pasch, A. Penny and R. Berg, "National Hurricane Center Tropical Cyclone Report: Hurricane Maria." National Hurricane Center, April 2018 https://www.nhc.noaa.gov/data/tcr/AL152017_Maria.pdf

Chart 4: Jobless Claims Spike

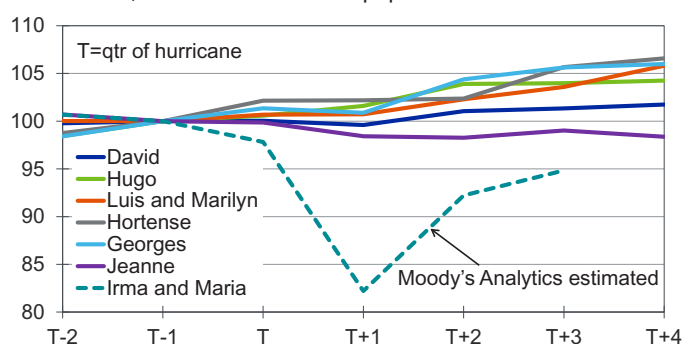
Puerto Rico, initial unemployment claims, % of population



Sources: Census Bureau, ETA, Moody's Analytics

Chart 5: Output Typically Unscathed

Puerto Rico, real GDP indexed to qtr prior to hurricane



Sources: BEA, Planning Board of Puerto Rico, Moody's Analytics

Counting the cost

Real GDP data for Puerto Rico is unavailable for the period during and after Irma and Maria. As a result, Moody's Analytics estimated lost output using a simple model that factors in high-frequency data including the monthly Economic Activity Index, published by the Economic Development Bank for Puerto Rico, and population (see Table 1).

The EAI, whose methodology is similar to that of the Conference Board's coincident index of the U.S. economy, is closely correlated to Puerto Rico's real GDP. The index comprises four indicators: payroll employment, electric power generation, cement sales, and gas consumption. Employment and power generation have weighed down the top-line EAI most. On the other hand, cement sales and gasoline spending have propelled the apparent rebound in economic activity, both even hitting multiyear highs (see Chart 6). This suggests the stimulus from rebuilding has kicked in. The ongoing reconstruction of residential structures, public buildings, and transportation infrastructure is a boon for cement sales, while FEMA's mobilization of the local trucking industry to haul hurricane relief supplies caused a temporary pop to gas consumption.

Demographics also matter when estimating real-time economic trends, because they capture underlying domestic demand. The Census Bureau has published population figures for the island only through the second quarter of 2017. So, we estimated quarterly changes in the population due to outmigration, using net domestic air passenger ar-

rivals at Puerto Rico's three largest airports, which are available through May (see Table 2). Net arrivals correlate strongly with the Census Bureau's net migration estimates.

The exodus at the time of Irma and Maria is eye-popping (see Chart 7). In the prior

decade, between 50,000 to 100,000 more domestic passengers departed from Puerto Rico's main airports than arrived each year. In 2017, a near 275,000 more domestic passengers departed than arrived. Though the Bureau of Transportation Statistics does not

Table 1: Estimating the Real-Time Economic Loss From Irma and Maria

Dependent variable: Dlog(real GDP)

Dlog(Economic Activity Index)	0.75* (0.08)
Dlog(Population)	1.14* (0.32)
N	145
Adjusted R ²	0.42

Numbers in parentheses represent standard errors. *The level of significance is 1%. The frequency for the regression is quarterly.

Sources: BEA, Census Bureau, Economic Development Bank, Planning Board of Puerto Rico, Moody's Analytics

Table 2: Quantifying Out-Migration Pressures Due to Irma and Maria

Dependent variable: 4-qtr moving sum(net migration)

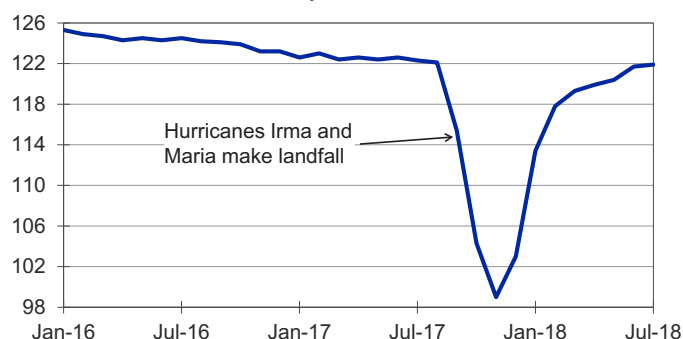
Constant	-17.59* (2.38)
4-qtr moving sum(net domestic air passenger arrivals)	0.58* (0.04)
N	55
Adjusted R ²	0.76

Numbers in parentheses represent standard errors. *The level of significance is 1%. The frequency for the regression is quarterly.

Sources: Bureau of Transportation Statistics, Census Bureau, Moody's Analytics

Chart 6: Signs of Post-Hurricane Stimulus

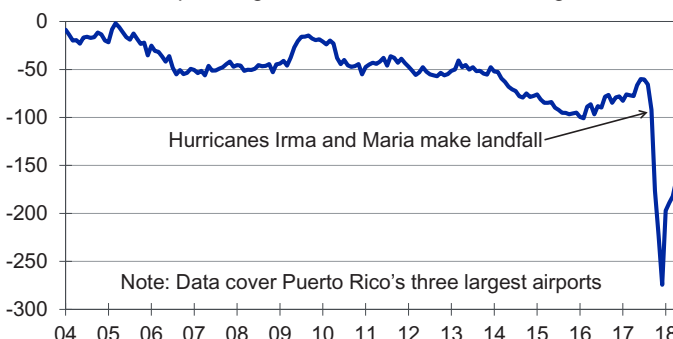
Puerto Rico, Economic Activity Index, Jan 1980=100



Sources: Economic Development Bank, Moody's Analytics

Chart 7: An Unprecedented Exodus

Net domestic air passenger arrivals, ths, 12-mo moving sum



Sources: Bureau of Transportation Statistics, Moody's Analytics

report net arrivals farther back than 2003, the much longer time series of net migration from the Census Bureau has never shown a similar spike in outmigration during any other major hurricane to affect Puerto Rico.

Puerto Ricans, who relocated to the mainland before and after Irma and Maria, have begun to return home. In the first quarter of 2018, a record 78,000 more domestic passengers arrived at Puerto Rico's airports than departed. Many still have yet to return, however, and it is uncertain whether they ever will. According to net arrival data for the second quarter, the net in-migration at the start of the year was short-lived, and more residents are now departing by plane than arriving at about the same net level as before. If this sticks, it would mean Maria will have made a permanent dent in the population.

Because of these high-frequency indicators, it is possible to gauge lost output from

Irma and Maria. Both hurricanes made landfall toward the end of third quarter of 2017, so the hit to output for the quarter was limited. Moody's Analytics estimates real GDP fell only 2% quarter over quarter. However, the lion's share of lost output came in the fourth quarter of 2017, when real GDP was estimated to have plunged by 15% quarter over quarter. Economic conditions began to turn around at the start of 2018, as the effect of rebuilding strengthened, electricity was restored, and Puerto Ricans began returning home from the mainland. We estimate real GDP bounced back by 12% in the first quarter and grew a near 3% in the second quarter.

The last straw

The estimated economic loss is harrowing but unsurprising. The economy was barely getting back on its feet after Irma when Maria slammed into Puerto Rico, bringing down 80% of its utility poles and all transmission

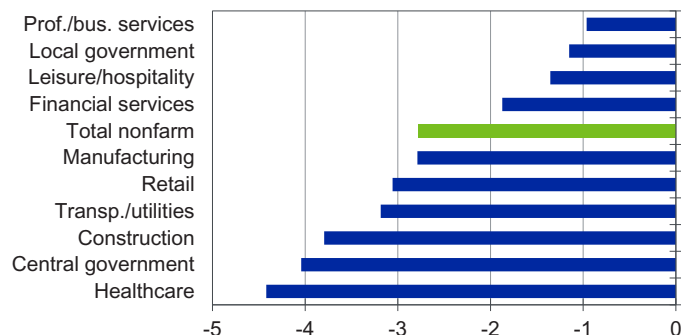
lines—effectively plunging the whole island into darkness. Virtually all cell phone service was dead, potable water services ceased, and only 400 miles of roads were navigable out of a total of 16,700 miles. Almost half of all Puerto Ricans were still in the dark by the end of

2017. A month later, power was restored to around 65% of residents. It was not until the spring that electricity was back in nearly all parts of the island. All told, Maria is considered to have caused the largest blackout in U.S. history in terms of customer-hours of lost electricity service.⁶

Though employment is down from pre-Maria levels across the board, some industries have recovered more than others (see Chart 8). White-collar industries have fared better than most. Such businesses could probably afford to run their own generators in Maria's aftermath and are largely located in urban centers, where electricity tended to be restored faster than in less populated areas. Municipalities seem to be benefiting from the post-Maria stimulus, whereas central government payrolls are still locked in a secular decline. Leisure/hospitality is staging a comeback, as mainland tourists, who are buoyant on top of faster wage growth, return to the island. On the other hand, factories are struggling; more than half of respondents in Puerto Rico's manufacturing PMI have reported this year that a lack of reliable electricity still affects their operations. Healthcare, which has long suffered from an exodus of doctors to the mainland, has barely budged after contracting severely in Maria's wake.⁷

Chart 8: An Uneven Recovery

Puerto Rico, payrolls, % diff from pre-hurricane level, Jul 2018



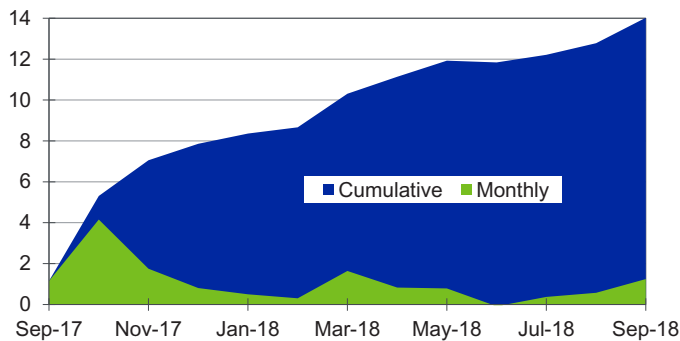
Sources: BLS, Moody's Analytics

⁶ Trevor Houser and Peter Marsters, "The World's Second Largest Blackout," Rhodium Group Research, April 2018. <https://rhg.com/research/puerto-rico-hurricane-maria-worlds-second-largest-blackout/>

⁷ "Puerto Ricans Brace for Crisis in Health Care," *New York Times*, August 2015. <https://www.nytimes.com/2015/08/03/us/health-providers-brace-for-more-cuts-to-medicare-in-puerto-rico.html>

Chart 9: FEMA Drives Federal Response

Obligations from the Disaster Relief Fund for Puerto Rico, \$ bil



Sources: FEMA, Moody's Analytics

Although Puerto Rico is not better off than it was prior to Maria, Moody's Analytics believes that over time economic welfare will improve. The greatest long-term risk to the economy is that the upheaval from Maria proves the final straw for many residents, with the end result a permanent increase in the rate of population loss.

Fits and starts

The road to recovery on the back of private insurance payouts and federal disaster relief has begun, but it is never a smooth one. Private insurers reportedly delayed disbursing insurance payments to thousands of policyholders, prompting the Office of the Insurance Commissioner of Puerto Rico to fine many insurers for such delays. Distributing aid supplies from Puerto Rico's ports to the rest of the island across damaged roads was a logistical nightmare for FEMA. A brief disagreement between the commonwealth government and the U.S. Treasury on the conditionality of Community Disaster Loans highlighted the difficulty in coordinating local and federal responses. Federal disaster spending can also get bogged down for other reasons. Verifying eligibility for benefits and preventing duplication of benefits can prolong the roll-out of individual assistance. Moreover, compliance with local zoning and environmental laws and public comment periods can delay infrastructure projects.

Despite these issues, federal aid matters. By far the most important share of appropriations to disaster-stricken areas is deployed by FEMA, which has obligated \$14 billion

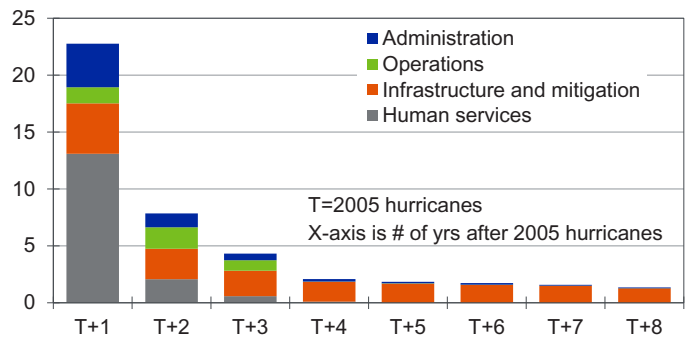
from its Disaster Relief Fund for Puerto Rico (see Chart 9). Half of the disbursements occurred between September and November 2017. Since then, outlays from the DRF have ebbed and flowed. This pattern is typical of FEMA's response to past hurricanes, particularly the 2005 hurricanes, when DRF funding was front-loaded in the first six months.

The first year after a disaster is therefore the costliest to FEMA (see Chart 10). Operations and human services, which include food and shelter as well as rescue and search efforts, account for the lion's share of spending in that first year.⁸ FEMA also bears the highest administrative costs that initial year. By comparison, infrastructure assistance and post-disaster hazard mitigation are less important in the first year. Much of that spending is directed to debris removal. Yet, in subsequent years, these outlays make up most or virtually all of FEMA expenditures as they are slowly disbursed to help reconstruct public infrastructure and fund hazard-mitigation projects aiming to lower the long-run risk to residents and property from future disasters.

⁸ Daniel Hoople, "The Budgetary Impact of the Federal Government's Response to Disasters," Congressional Budget Office, September 2013.

Chart 10: FEMA Spending Is Immediate

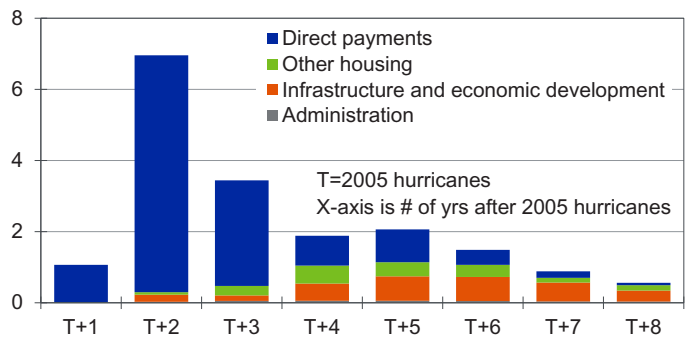
Est. outlays from Disaster Relief Fund by program area, \$ bil



Sources: CBO, Moody's Analytics

Chart 11: Response From HUD Is Delayed

Community Development Fund spending by program area, \$ bil



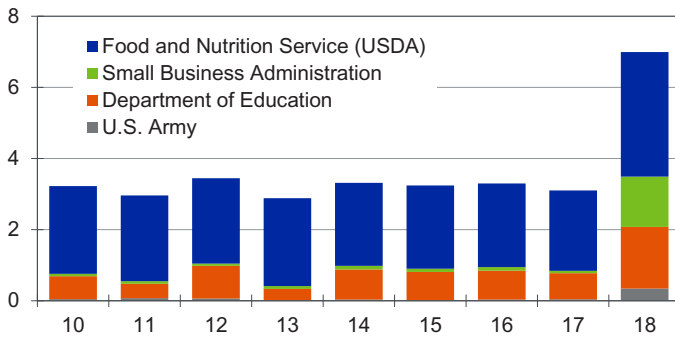
Sources: CBO, Moody's Analytics

The Department of Housing and Urban Development usually plays the next biggest role in federal disaster spending through its Community Development Fund. HUD was slow to turn on the CDF spigot in the first year after the 2005 hurricane season (see Chart 11). However, in the second year, outlays from the CDF came in fast mostly in the form of direct payments to homeowners and utilities. In the following years, funding for housing programs and infrastructure and economic development made up an ever larger share of CDF expenditures. The time required for the application and disbursement of Community Development Block Grants, which help support such initiatives, means they will be spread over time.

Besides FEMA and HUD, other federal agencies are chipping in. Real-time data on contracts for goods and services, grants, loans, and other financial assistance give us a sense of their contributions (see Chart 12).

Chart 12: Other First Responders

Federal awards disbursed to Puerto Rico by fiscal yr, \$ bil

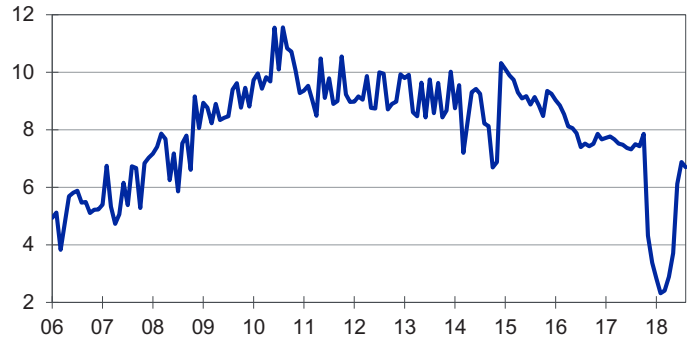


Sources: USAspending.gov, Moody's Analytics

Note: 2018 figures are fiscal YTD

Chart 13: Forbearance for Homeowners

Puerto Rico, residential loans, total delinquency rate, %



Sources: Equifax, Moody's Analytics

The Food and Nutrition Service has upped its food assistance through its Disaster Household Distribution program and school meals programs. The Department of Education has distributed Title I Grants to Local Educational Agencies to restart school operations and defray the cost of enrolling displaced students. U.S. Army contract spending has increased, as the Army Corps of Engineers assiduously restored electricity. Finally, the Small Business Administration is plowing low-interest disaster loans to businesses, homeowners and renters.

Temporary reprieve

The ability of households and businesses to renew their economic lives is limited if they are burdened by the economic obligations that prevailed prior to the disaster. Before Maria, foreclosures were among the highest in the U.S., with more than 6% of mortgage loans somewhere in the foreclosure process—compared with close to 1% nationally. As a result, financial forbearance was especially important after Maria. Indeed, many banks granted temporary reprieves on mortgage payments, sending the delinquency rate on residential loans to unprecedented lows (see Chart 13). Delinquencies have since returned close to pre-hurricane levels, as those moratoriums expired. However, the Federal Housing Administration has repeatedly extended its own foreclosure moratorium for FHA-insured homeowners, which it did for the last time in August while expanding its menu of foreclosure prevention options. Yet, substantial confusion remains

among FHA-insured borrowers, of whom few have reportedly enrolled in the foreclosure prevention program.

Easier said than done

Natural disasters do not have to be economic disasters. For every Katrina, where the economic policy response was unorganized and ineffectual, thereby letting the affected economies struggle more than necessary, there is a counterexample in which the post-disaster response promptly restarted the economy (see Chart 14). Hurricane Ivan devastated Grenada in 2004. Nevertheless, in the next quarters, the Caribbean country's economy grew at a record pace, riding the coattails of the relief aid it received.

Rebuilding, if done properly, can play an important role in replacing old and outdated infrastructure. The sheer scale of lost output due to the prolonged, island-wide blackout in Puerto Rico was in many respects man-made. The median plant age of the Puerto Rico Electric Power Authority is 44 years, more than twice the industry average. The most important generating facilities are in the south of the island, while most of the power consumption is in the north. Transmission lines crossing over mountainous ter-

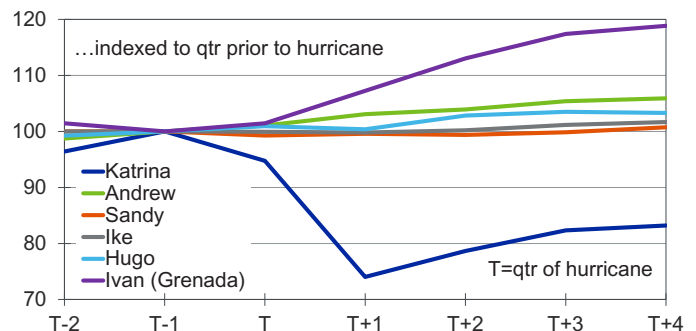
rain connect the two coasts and are vulnerable to high winds that are amplified by the changing terrain.

Installing microgrids, which can power remote communities and critical infrastructure in isolation if they are disconnected from the central grid, and either reinforcing electric poles or installing underground power lines in areas that are susceptible to high winds would have helped limit the output loss after Maria. Yet, modernizing the grid will be no small cost, given all the years of underinvestment. Still, it is worth the effort, since hurricanes are now more frequent and disastrous threats than before (see Chart 15).

Modernization is not the only ingredient to successful rebuilding; ensuring best practices is another. This especially concerns the housing stock. In the past, under-resourced inspectors and too much construction that was allowed to proceed without permits led to many residential structures that were

Chart 14: A Wide Range of Outcomes

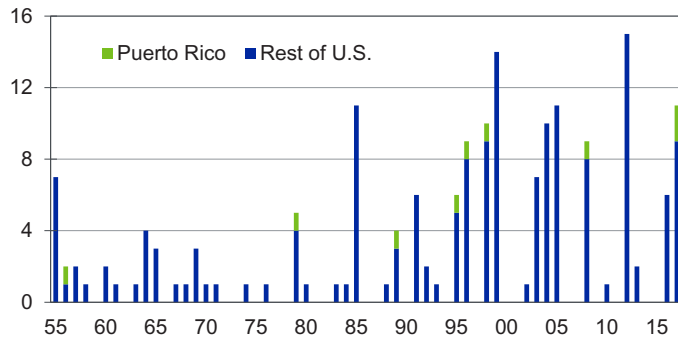
Real GDP in U.S. metro area or country worst hit by hurricane...



Sources: BEA, United Nations, Moody's Analytics

Chart 15: More Threats Than Before

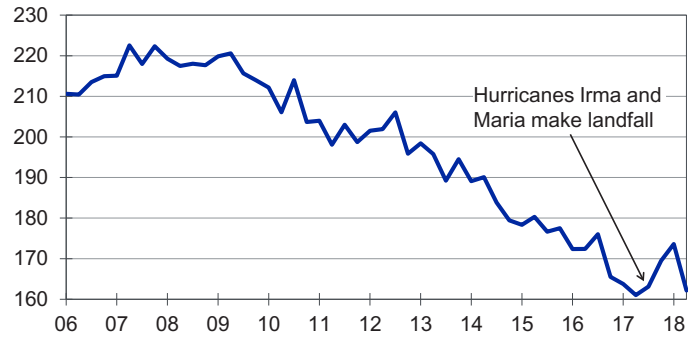
of major Atlantic hurricane disasters declared in...



Sources: FEMA, Moody's Analytics

Chart 16: For-Sale Inventory Is Wiped Out

Puerto Rico, FHFA House Price Index, 1995Q1=100



Sources: FHFA, Moody's Analytics

either noncompliant with protective building codes or even located in areas prone to flooding and landslides. The destruction to the housing stock was so vast that house prices temporarily increased, since the supply shock outweighed the hit to demand from hurricane-induced outmigration (see Chart 16). Therefore, post-Maria rebuilding presents an opportunity for authorities to enforce stricter building codes across more of the housing stock than before.

All of this is easier said than done. The economic backstory of a region or country matters when considering the post-disaster prognosis. The ideal level of funding is not always available. Yet, to avoid unnecessary economic pain down the road, effective policymaking is crucial.

Three policy paths for Puerto Rico

The post-Maria recovery effort is far from over. Though most disaster relief occurs in

the first two years, it carries on for many years after. Eight years after the 2005 hurricanes, the federal government had not spent more than 7% of the money that was initially appropriated for the disaster relief (see Chart 17). Therefore, actions taken by the commonwealth and federal governments in the next years can still influence the outcome of Puerto Rico's recovery.

In the rest of this article, we consider three potential policy directions that policymakers in Washington and San Juan can take: Governor Ricardo Rosselló's reconstruction plan, the federal control board's new fiscal plan, and the Rubio-Hatch bill. Some caveats are in order before we review each plan and their economic implications.

The starting point of our three policy scenarios is the baseline assumption that at least \$62 billion in disaster relief will be spent over the next 10 years in Puerto Rico. The three scenarios will differ from one

scenario forecasts, starting in the third quarter of 2018.

To determine the time path of disaster relief spending, we use historical outlays in the years after the 2005 hurricanes as our guide. When modeling the economic effect, we strip out spending on administration, operations, and goods and services that are imported from the mainland.

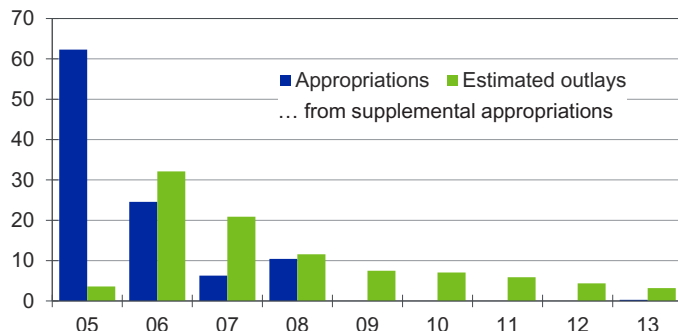
These are purely economic scenarios that do not factor in other variables such as debt repayment, external financing, and budget balances. The assumption in all scenarios is that Puerto Rico muddles along over the next decade without an outright financing crisis.

Economic and Disaster Recovery Plan

In early August, the commonwealth presented to Congress an ambitious recovery plan. Known as the Economic and Disaster Recovery Plan, it carries a hefty price tag of \$139 billion over the next decade. This is greater than the \$94 billion Governor Rosselló requested from Congress in November and would amount to more than 1½ times the island's estimated GDP currently. The plan would fund an array of capital investments, prioritizing housing, water systems, and the energy grid (see Chart 18). Of the \$139 billion, less than \$70 billion would be covered or financed by federal funding that is estimated to be available to Puerto Rico and private insurance claims. Nearly \$25 billion of the cost would be covered by federal funding that has been appropriated through three disaster-related supplemental bills and the normal

Chart 17: Disaster Relief Is a Long Affair

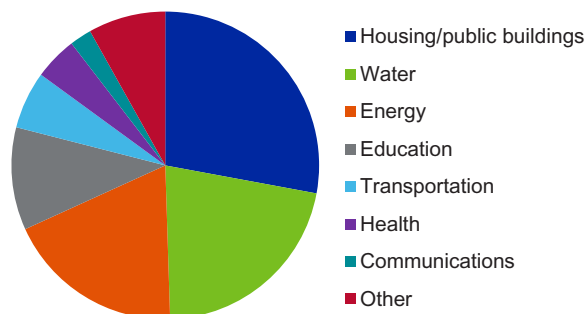
Budget authority and outlays for 2005 hurricanes by fiscal yr, \$ bil



Sources: CBO, Moody's Analytics

Chart 18: Key Thrusts in Recovery Plan

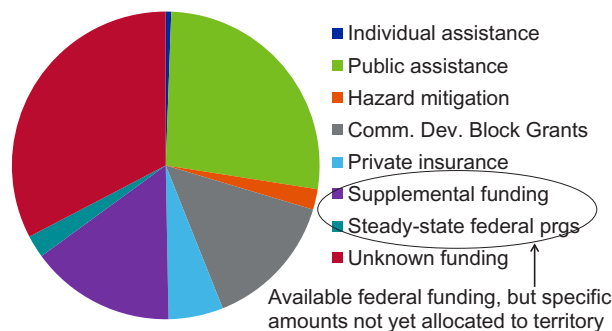
Requested amount for capital investments by category, %



Sources: CRRO, Moody's Analytics

Chart 19: Some Wishful Thinking

Economic and Disaster Recovery Plan by funding source, %



Sources: CRRO, Moody's Analytics

budgeting process but has not yet been allocated to the territory. Finally, \$45 billion, or a third of the total cost, is assumed to come from unknown funding sources that include the commonwealth itself, the private sector, and charitable foundations (see Chart 19).

The assumption of \$45 billion in unknown funding is a big stretch. Therefore, it was not included when the recovery plan was run through the Moody's Analytics econometric model for Puerto Rico. The federal control board overseeing the island's finances has pointed out that the recovery plan also pencils in much more federal funding than the board expects.⁹ Yet, for the purposes of this exercise, Moody's Analytics assumes that the remaining \$93 billion in federal funding and private insurance does materialize. This would still amount to a massive influx of post-disaster spending.

New Fiscal Plan for Puerto Rico

The next policy scenario is based on the New Fiscal Plan for Puerto Rico that the federal control board certified in late June.¹⁰ Under PROMESA, the governor and the board regularly work together to produce 10-year fiscal and economic growth plans, which the commonwealth is then expected to follow.

⁹ In an August letter to Congress, the federal control board certified that the commonwealth's recovery plan fulfills requirements from the Bipartisan Budget Act of 2018 but warned that the plan "estimates a much greater amount of federal funding than the certified fiscal plan for Puerto Rico projects."

¹⁰ In a letter to Governor Rosselló in early August, the board expects to certify the next fiscal plan for Puerto Rico on September 21, which comes after the publication of this article.

Table 3: More Government Austerity, Little Leniency Under Fiscal Plan

Spending cuts, \$ mil	FY18	FY19	FY20	FY21	FY22	FY23
Compensation	0	112.6	178.8	243.5	309.8	375
Payroll freeze	0	0	66.2	130.9	197.2	262.4
Uniform healthcare	0	45.9	45.9	45.9	45.9	45.9
Christmas bonus	0	66.7	66.7	66.7	66.7	66.7
Agency right-sizing	0	302.4	706.2	1,020	1,151	1,201
Healthcare reform	49	154	500	750	795	839
Reduced subsidies to...	23	115	245	360	427	451
Municipalities	0	44	88	132	176	176
UPR	23	71	157	228	251	275
Pension reform	0	0	185	182	179	185
Office of the CFO	77	68	69	70	71	72

Sources: FOMB, Moody's Analytics

The process has been far from smooth, with the board advocating for austerity and the governor resisting. The board has the last say, though. Given that the board will continue to shape Puerto Rico's fiscal trajectory for years to come, it is worth modeling the post-disaster aid assumptions and certain fiscal proposals contained in the latest fiscal plan certified by the board.

The new fiscal plan shares the Moody's Analytics baseline assumption of \$62 billion in disaster relief over the next 10 years. This is about \$30 billion less than assumed under the recovery plan scenario but still represents about three-quarters of Puerto Rico's estimated GDP currently. Federal funding makes up most of this total, followed by private insurance. However, this scenario is distinguished from the other two by the austerity it backs (see Table 3).

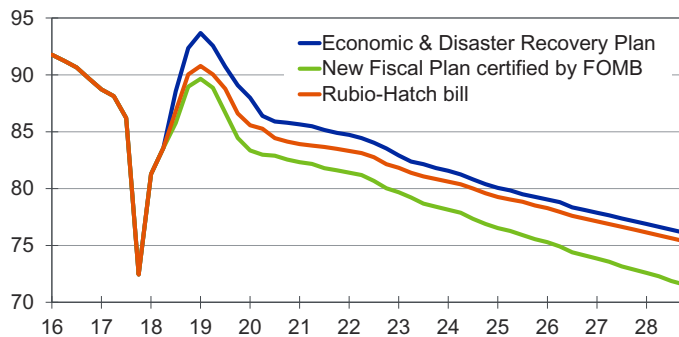
Over the next six years, the fiscal plan calls for more than \$1 billion in cuts to government compensation through a payroll freeze, standardizing healthcare benefits, and ending the Christmas bonus for public employees. Other belt-tightening measures would lead to \$11 billion less in government spending over the next six years.¹¹ There is a modest offset to the fiscal tightening, though: implementation of a new earned income tax credit, costing slightly more than \$200 million per year.

Fiscal rectitude is never easy, but it will be especially hard in Puerto Rico, where one

¹¹ These include: consolidating, downsizing and shuttering certain public bodies while streamlining the operations of others; reducing subsidies to municipalities and the University of Puerto Rico; implementing an average 10% cut to pensions; reining in healthcare spending; and achieving greater financial accountability through the Office of the CFO.

Chart 20: The Three Policy Scenarios

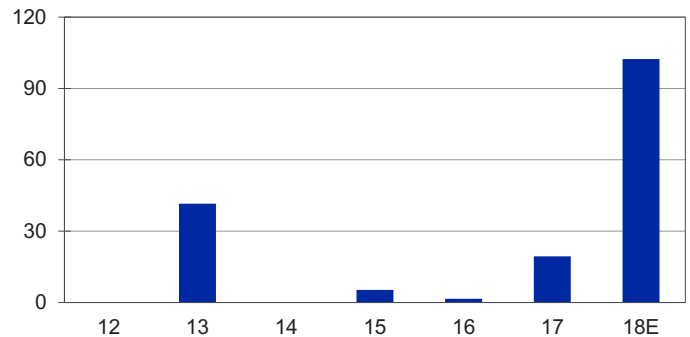
Puerto Rico, GDP, 2009\$ bil, SAAR



Sources: BEA, Planning Board of Puerto Rico, Moody's Analytics

Chart 21: Picking up the Tab

Fed discretionary nondefense funding for emergencies, FY, \$ bil



Sources: CBO, Moody's Analytics

in five workers is employed by either the commonwealth or a municipality. By comparison, state and local governments employ one in 10 workers nationally.

Rubio-Hatch bill

The third and final policy scenario centers on the Puerto Rico Economic Empowerment Act of 2018, introduced by Senators Orrin Hatch and Marco Rubio in May. The bill largely aims to provide tax relief to Puerto Ricans in two ways. First, it would institute a two-year "payroll tax holiday," which halves payroll taxes to 3.1%. Second, it would extend the federal child tax credit to Puerto Rican families with one or two children. Currently, only Puerto Rican families with three or more children are eligible to receive the CTC. There are two other provisions in the Rubio-Hatch bill, including greater flexibility for Small Business Administration programs in Puerto Rico, but their economic impacts pale in comparison with the proposed tax relief.

The payroll tax holiday would provide around \$1.4 billion in tax relief, lasting from the third quarter of 2018 through the second quarter of 2020. Meanwhile, the expansion of the CTC would deliver a much larger windfall of about \$4.2 billion over the next 10 years, since it would be effective for all tax years after December 31, 2017. The Rubio-Hatch bill does not make any assumptions about post-disaster spending levels, so in this scenario, Moody's Analytics assumes the same \$62 billion in disaster relief as it did in the new fiscal plan scenario.

Takeaways and conclusions

Puerto Rico's economy is in for a roller-coaster ride over the next couple of years. How steep and dizzying the ride turns out to be will depend on the fiscal boost the island receives. Across all three scenarios, the economy rebounds through early 2019 (see Chart 20). Under the governor's reconstruction plan, real GDP grows the fastest, since its post-disaster stimulus is unmatched. The economy under the Rubio-Hatch scenario does increasingly better over the next two years than under the new fiscal plan. This is because of the payroll tax holiday taking effect during the second half of 2018, alongside the CTC expansion. At the same time, the new fiscal plan's austerity measures begin in earnest. The economy comes off its disaster relief-induced sugar high in 2020 across all three scenarios.

From then on, the economy is caught in a relatively gentle decline during the latter years of the forecast, no matter the scenario. Economic output under the reconstruction plan and Rubio-Hatch scenarios converges, while the performance gap between the new fiscal plan and the other two scenarios widens as the board's austerity measures compound over time.

The results from these scenarios underscore some important issues for policymakers. In the short term, disaster relief greatly affects the economy's trajectory because of the front-loaded nature of such spending. Yet, over the long term, demographics are destiny. As long as the population continues to decline and the young and the skilled

continue to migrate, leaving behind an older population, the economy will revert to its underlying downward trend, regardless of the initial amount of post-disaster spending.

Based on this conclusion, it is easy to understand why federal fiscal policymakers might opt for the Rubio-Hatch scenario over the reconstruction plan, because the difference in output at the end of 10 years may not be large enough to justify the much higher bill that the federal government would have to help pay for the reconstruction plan. The cost of disaster relief is not trivial for the federal government. Funding for emergency requirements in fiscal 2018 is expected to be nine times larger than the average amount over the past six years (see Chart 21). However, this conclusion ignores two benefits from greater post-disaster spending in the immediate aftermath: one that is modest and captured in our results and the other that is potentially consequential but only hypothetical at this point.

The main determinant of net migration in the Moody's Analytics econometric model for Puerto Rico is the relative jobless rate between the U.S. and the territory. During the first two years of the scenarios, the greater post-Maria stimulus under the reconstruction plan reduces the unemployment rate to a greater extent than the other two scenarios. As a result, out-migration is lower under the reconstruction plan in those early years, leaving the population slightly larger in the long term vis-à-vis the other two scenarios (see Appendix). Reducing out-migration pressures in whatever way possible

should be an urgent goal of any post-Maria economic strategy.

Greater post-disaster spending, if properly done, should lead to more of the island's critical infrastructure being modernized and rebuilt to be resilient. Though the Moody's Analytics econometric model cannot predict the next hurricane to wreak havoc in Puerto Rico, Maria will not be the last. If the higher level of federal funding under the reconstruction plan scenario were used effectively and those extra funds made the economy more resilient against the next hurricane, it could lead to even stronger economic prospects, relative to the Rubio-Hatch scenario, when the next powerful storm hits.

Finally, the new fiscal plan by the board presents another crucial trade-off for policymakers. Achieving fiscal responsibility and sustainable balanced budgets are necessary if Puerto Rico wants any chance of accessing external financing in credit markets. However, the road to this endgame cuts through austerity, which, as these scenarios show, comes with its own economic and human cost. There are ways to blunt the negative impact from austerity. The new fiscal plan, for instance, calls for a series of structural reforms from improving human capital and welfare laws, to knocking down barriers to doing business, to reducing energy costs, all of which the board expects to boost economic activity. More like-

ly than not, the economic benefits from such structural reforms will take longer to manifest themselves—even beyond the 10-year horizon of this exercise—whereas the costs of austerity would be immediate, potentially exacerbating out-migration and other problems on the island.

The results from these scenarios shed light on all trade-offs that federal and Puerto Rican policymakers will have to weigh in years to come. The island is not only recovering from a once-in-a-lifetime natural event but also a decade-long recession. Effective policymaking at all three levels of government can make a difference in Puerto Rico's long-run economic prospects.

Appendix: Sizing Up the Three Policy Scenarios

Economic and Disaster Recovery Plan

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	Avg annual growth 2017-2028
Nonfarm employment (thrs)	871.9	866.4	885.4	859.3	852.7	846.3	836.0	828.4	820.6	814.0	807.3	800.9	-0.9
% change	-2.5	-0.6	2.2	-3.0	-0.8	-0.8	-1.2	-0.9	-0.9	-0.8	-0.8	-0.8	
Gross state product (2009\$ bil)	83.9	86.4	91.5	86.5	85.3	84.2	82.3	81.0	79.7	78.6	77.5	76.5	-1.4
% change	-7.7	3.1	5.9	-5.5	-1.4	-1.3	-2.2	-1.6	-1.6	-1.4	-1.4	-1.3	
Unemployment rate, %	10.9	9.6	9.1	9.5	9.8	10.4	10.9	11.3	11.9	12.3	12.7	12.8	
Civilian labor force (thrs)	1,102.5	1,096.6	1,102.0	1,095.3	1,096.1	1,098.1	1,096.1	1,092.2	1,088.4	1,083.8	1,077.2	1,070.2	-0.4
% change	-1.5	-0.5	0.5	-0.6	0.1	0.2	-0.2	-0.4	-0.3	-0.4	-0.6	-0.7	
Population (thrs)	3,295.0	3,183.6	3,143.2	3,110.9	3,075.9	3,038.1	2,996.7	2,954.5	2,913.1	2,871.8	2,830.2	2,788.3	-1.6
% change	-3.0	-3.4	-1.3	-1.0	-1.1	-1.2	-1.4	-1.4	-1.4	-1.4	-1.4	-1.5	
Net migration (thrs)	-207.5	-15.7	-41.9	-43.0	-45.2	-48.9	-51.1	-50.1	-49.2	-48.8	-48.6	-48.5	
Disposable personal income (2009\$ mil)	54,962.3	53,157.0	54,742.8	53,247.8	51,933.0	50,672.6	49,024.7	47,593.4	46,087.2	44,560.0	43,173.0	41,984.1	-2.3
% change	-1.4	-3.3	3.0	-2.7	-2.5	-2.4	-3.3	-2.9	-3.2	-3.3	-3.1	-2.8	
Wages and salaries (\$ mil)	21,488.6	21,411.7	22,392.4	22,184.4	21,920.4	21,767.0	21,539.6	21,407.7	21,304.7	21,258.0	21,270.5	21,331.8	-0.2
% change	-2.4	-0.4	4.6	-0.9	-1.2	-0.7	-1.0	-0.6	-0.5	-0.2	0.1	0.3	

Fiscal Plan Certified by FOMB

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	Avg annual growth 2017-2028
Nonfarm employment (thrs)	871.9	859.2	868.5	844.2	836.8	830.9	821.5	814.2	806.4	799.1	792.2	785.4	-1.1
% change	-2.5	-1.5	1.1	-2.8	-0.9	-0.7	-1.1	-0.9	-1.0	-0.9	-0.9	-0.9	
Gross state product (2009\$ bil)	83.9	84.9	87.4	82.9	82.0	80.8	79.0	77.6	76.1	74.7	73.4	72.1	-1.9
% change	-7.7	1.2	3.0	-5.1	-1.2	-1.4	-2.3	-1.8	-1.9	-1.8	-1.8	-1.7	
Unemployment rate, %	10.9	10.1	10.3	10.6	11.0	11.5	12.0	12.4	13.0	13.5	13.9	14.1	
Civilian labor force (thrs)	1,102.5	1,095.2	1,096.7	1,088.5	1,088.7	1,090.0	1,087.4	1,082.7	1,078.0	1,072.4	1,064.8	1,056.7	-0.5
% change	-1.5	-0.7	0.1	-0.8	0.0	0.1	-0.2	-0.4	-0.4	-0.5	-0.7	-0.8	
Population (thrs)	3,295.0	3,183.0	3,132.6	3,092.0	3,054.7	3,013.8	2,969.0	2,923.4	2,878.5	2,833.2	2,787.5	2,741.3	-1.8
% change	-3.0	-3.4	-1.6	-1.3	-1.2	-1.3	-1.5	-1.5	-1.5	-1.6	-1.6	-1.7	
Net migration (thrs)	-207.5	-18.1	-54.5	-48.2	-47.4	-51.8	-54.5	-53.5	-52.7	-52.7	-52.6	-52.8	
Disposable personal income (2009\$ mil)	54,967.8	52,781.8	53,262.1	51,421.2	49,849.8	48,423.2	46,627.4	44,982.2	43,248.4	41,441.2	39,778.4	38,288.8	-3.1
% change	-1.4	-4.0	0.9	-3.5	-3.1	-2.9	-3.7	-3.5	-3.9	-4.2	-4.0	-3.7	
Wages and salaries (\$ mil)	21,488.6	21,161.3	21,692.0	21,347.1	20,951.0	20,704.4	20,424.9	20,246.6	20,091.2	19,970.2	19,909.7	19,889.2	-0.8
% change	-2.4	-1.5	2.5	-1.6	-1.9	-1.2	-1.3	-0.9	-0.8	-0.6	-0.3	-0.1	

Rubio-Hatch Bill

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	Avg annual growth 2017-2028
Nonfarm employment (thrs)	871.9	861.7	875.5	853.8	847.4	842.4	833.7	827.0	819.8	813.1	806.6	800.3	-0.9
% change	-2.5	-1.2	1.6	-2.5	-0.7	-0.6	-1.0	-0.8	-0.9	-0.8	-0.8	-0.8	
Gross state product (2009\$ bil)	83.9	85.4	89.0	84.9	83.7	82.8	81.3	80.1	78.9	77.8	76.8	75.8	-1.5
% change	-7.7	1.9	4.2	-4.7	-1.3	-1.0	-1.9	-1.4	-1.5	-1.4	-1.3	-1.3	
Unemployment rate, %	10.9	9.9	9.8	9.9	10.2	10.7	11.1	11.5	12.0	12.5	12.8	12.9	
Civilian labor force (thrs)	1,102.5	1,095.7	1,098.7	1,092.1	1,093.0	1,095.1	1,093.3	1,089.5	1,085.8	1,081.1	1,074.5	1,067.5	-0.4
% change	-1.5	-0.6	0.3	-0.6	0.1	0.2	-0.2	-0.3	-0.3	-0.4	-0.6	-0.7	
Population (thrs)	3,295.0	3,183.2	3,136.2	3,100.6	3,066.1	3,027.6	2,985.8	2,943.5	2,902.1	2,860.5	2,818.6	2,776.4	-1.7
% change	-3.0	-3.4	-1.5	-1.1	-1.1	-1.3	-1.4	-1.4	-1.4	-1.4	-1.5	-1.5	
Net migration (thrs)	-207.5	-17.2	-50.0	-43.4	-45.4	-49.1	-51.4	-50.1	-49.2	-49.1	-48.8	-48.7	
Disposable personal income (2009\$ mil)	54,967.8	53,494.1	54,813.1	53,149.7	51,542.3	50,345.2	48,792.1	47,415.8	45,946.3	44,404.1	43,015.9	41,812.8	-2.4
% change	-1.4	-2.7	2.5	-3.0	-3.0	-2.3	-3.1	-2.8	-3.1	-3.4	-3.1	-2.8	
Wages and salaries (\$ mil)	21,490.9	21,279.9	22,045.0	21,893.3	21,632.3	21,507.0	21,319.8	21,212.5	21,126.9	21,077.2	21,092.1	21,151.1	-0.3
% change	-2.4	-1.0	3.6	-0.7	-1.2	-0.6	-0.9	-0.5	-0.4	-0.2	0.1	0.3	

Sources: BEA, BLS, Census Bureau, Moody's Analytics

About the Author

Bernard Yaros is an economist at Moody's Analytics focused primarily on federal fiscal policy. Bernard is responsible for maintaining the Moody's Analytics forecast models for federal government fiscal conditions and state tax revenues. Additionally, he covers Virginia and Puerto Rico, develops forecasts for Switzerland, and manages a database of global subnational forecasts for Europe, Asia and Mexico. Bernard holds an MSc in international trade, finance and development from the Barcelona Graduate School of Economics and a BA in political economy from Williams College.

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